

Chapter 3.2 ASSESSMENT METHODOLOGIES (Percent Method and Binomial Method)

Virginia's biennial water quality assessment begins by analyzing the water quality data from ambient, biological, sediment and fish tissue monitoring stations. The results of these comprehensive data analysis are compared with both numeric and narrative goals contained in the Water Quality Standards (WQS). The results of these comparisons are presented in the 305(b) and 303(d) reports. The WQS are provisions of State and/or Federal Law that contain the designated uses for the waters of the Commonwealth. Included in the standards are the numerical and narrative criteria for protecting these uses.

There are two basic types of water quality data used in the assessment process. **Monitored** data comes from the collection and analysis of chemical, biological, and physical samples taken by DEQ, U.S. Geological Survey, U.S. Forest Service, TVA, QA/QC approved citizen monitoring programs and/or other special studies. Monitored data is obtained through a sampling and testing protocol that has been approved by DEQ and EPA. The second type of data used in the assessment is called **Evaluated** data. This physical, chemical, or biological data is primarily obtained from sources where there is not an approved sampling and testing protocol or some other water quality **predictive** assessment technique. For the 305(b) report, only EPA approved **monitored** data is used to classify waters **not fully supporting** due to the assessment confidence associated with quality control/quality assurance monitoring requirements unless some "administrative" action has been taken to remove a designated use. An example of this would be a VDH restriction of shellfish use due to the presence of a sewage treatment plant outfall. "Evaluated" data are primarily used to rank or prioritize waters for potential water quality degradation or impairment and assist in the siting of monitoring stations in high priority waters.

Designated Uses of Virginia's Waters

Water Quality Standard 9 VAC 25-260-10 defines the Designation of Uses. It states: "*All state waters, including wetlands, are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g. fish and shellfish.*" In the biennial water quality assessment process, three "primary" designated uses and two "secondary" designated uses are assessed to determine if the waters meet this Standard. The primary designated uses are **aquatic life use, recreational use (swimming and boating) and use as public water supply**. Along with these three primary uses, **fish consumption and shellfish consumption**, which are sub-categories of the aquatic life use, are assessed. Swimming use is assessed to represent both the swimming and boating recreational use.

Aquatic Life Use:

Includes the propagation, growth, and protection of a balanced indigenous population of aquatic life (including game and marketable fish) which may be expected to inhabit the waters.

Support of this use is determined by the assessment of conventional pollutants (dissolved oxygen, pH and temperature); toxic pollutants in the water column, toxic pollutant analysis of fish tissue and sediments and biological assessment of benthic communities.

Fish Consumption Use:

Support of this use is determined based on advisories and restrictions issued by the Virginia Department of Health (VDH). The public is advised that fish consumption is prohibited for the general population or there is an advisory that fish should not be consumed by the general population or sub-populations at greater risk such as children and/or pregnant women.

Shellfish Consumption Use:

Support of this use is based on human health related restrictive actions for the harvesting and

marketing of shellfish resources made by the Division of Shellfish Sanitation (DSS) of the Virginia Department of Health. Four classifications are used to describe shellfish waters. They are approved, conditionally approved, restricted, and prohibited. Approved areas are waters from which shellfish may be taken for direct marketing at all times. Conditionally approved areas are waters where the quality may be affected by a seasonal population increase or sporadic use of a dock or harbor facility. Restrictive areas are waters where a sanitary survey indicates a limited degree of contaminants which makes it unsafe to market shellfish for immediate consumption. Shellfish harvested in these areas must be moved to an approved area for a certain length of time to allow for depuration before marketing. Prohibited areas are waters where the sanitary survey indicates dangerous numbers of pathogenic microorganisms or other contaminants which could affect human health. Shellfish cannot be harvested or relayed for purification in prohibited areas. Those areas which are determined as non-productive for shellfish will not be assessed for this use. These areas are primarily Class II (Transition Zone and Tidal Freshwater) waters as defined in 9VAC 25-260-140 (C).

Swimming Use:

Includes swimming and other primary and secondary water contact recreation uses. Support of this use is based on fecal coliform bacteria data and the Department of Health (VDH) beach closures.

Public Water Supply Use:

Waters that are used for public drinking water supply are listed in the water quality standards and protected by additional standards which are applicable to these waters. Support of this use is based on Virginia Department of Health closures or advisories. Table 3.2-1 is a summary of the designated uses and the criteria used to demonstrate the support of the associated designated uses.

Table 3.2-1 **Designated Use Matrix**

NO.	Designated Use	Support of Use Demonstrated By
1	Aquatic Life Use	Conventional Pollutants (DO, pH, Temp.); Toxics in water column and comparison of sediments to screening values (SVs); Biological evaluation.
2	Fish Consumption Use	Advisories and restrictions limiting or restricting fish consumption issued by VDH. Comparison of fish tissue to ER-M screening values
3	Shellfish Consumption Use	Restrictive actions for harvesting and marketing of shellfish resources made by Div. Of Shellfish Sanitation of VDH.
4	Swimming Use	Conventional Pollutant (Fecal Coliform Bacteria instantaneous Standard) and/or beach closures
5	Public Water Supply Use	Closures or advisories limiting or restricting personal consumption issued by VDH.

Delineation of Monitored Waters and Segments

The Virginia Department of Environmental Quality (DEQ) has approximately 1,349 active Ambient Water Quality Monitoring (AWQM) stations and 271 (69 reference) biological stations statewide. The AWQM stations are monitored bi-monthly, monthly or quarterly, while the biological stations are monitored twice a year usually in the Spring and Fall. Monitoring programs can be designed based on conventional

(source targeted) or probability or a combination of the two. Each monitoring program design has its advantages and disadvantages. In the past, most of DEQ's monitoring strategy has been based on the conventional approach. Many of the stations were selected due to point source problems (VPDES permit dischargers). Over the recent years, some stations have been selected to monitor nonpoint source problems. In past 305(b) water quality assessment reports, there has been little consistency between the regions for determining the miles of stream impairment associated with each monitoring station. Most regions have strived to have at least one AWQM station in a watershed. If that station is determined to be representative of that watershed, then the total stream miles associated with that watershed were considered assessed. When an assessment revealed an impairment in water quality then the assessed miles for that specific monitoring station have been limited to a distance upstream and downstream which contains no significant change to water or habitat quality. The remaining stream miles have been evaluated as not assessed. In order to provide consistency between the regions and to get an accurate number of assessed stream miles in the state, the following guidelines are recommended:

- 1) One monitoring station should not be used to assess an entire watershed unless land use, source, and habitat are relatively homogeneous.
- 2) Typically no more than 10 miles of stream should be associated with a monitoring station for conventional pollutants as per EPA guidance. Miles assessed for a toxic pollutant or biological impairment may vary from the miles assessed for conventional pollutants.
- 3) When determining the miles assessed for a monitoring station, the following items need to be considered:
 - a) point or nonpoint source input to a stream or its tributaries,
 - b) changes in watershed characteristics such as land use,
 - c) changes in riparian vegetation, stream banks, substrate, slope, or channel morphology,
 - d) large tributary or diversion, or
 - e) hydrologic modification such as a channelization or a dam.

It is recommended that the above approach be phased in over the next couple of 305(b) assessment periods due to the many different considerations that must be made especially for physically or geographically changing watersheds.

Assessment Methodology

DEQ makes a biennial report to Virginia's citizens and the EPA on the condition of its waters. The waters are evaluated in terms of whether five designated uses are met: 1) aquatic life, 2) swimming (primary and secondary contact recreation), 3) shellfish harvest, 4) fish consumption, and 5) drinking water use. The following is a description of the conventional pollutant assessment methods used in the 2000 305(b) Report.

Through water quality monitoring, DEQ collects data under varied environmental conditions such as cold/warm weather and dry/rainy conditions. Each field datum is compared against the regulatory standard that protects the use. Aquatic life use is maintained if the standards for the conventional pollutants DO, pH, and water temperature are met for greater than 90% of the samples analyzed. Recreation use is maintained if the fecal coliform bacteria standard is met for greater than 90% of the samples analyzed. The task is to determine whether the DO, pH, temperature, and fecal coliform bacteria records indicate that the uses are being met. If the uses do not appear to be met, they may be considered "unconfirmed" and listed as threatened or confirmed and listed as not fully supporting.

Initially, each datum for the variables is compared against the regulatory standard. If the standard is exceeded, a violation has occurred. Because environmental conditions vary, it is possible for a violation to occur without signaling a significant environmental change causing the loss of designated uses. As Ward and Loftis (1983) quote from Roberts, Alone cannot ensure that a reasonable standard will never be violated@.

Consequently, while some measurements might violate water quality standards, a low violation rate is an insufficient reason to classify a stream as failing its designated use. The assessment challenge is to interpret the limited amount of sample data to determine whether an apparent violation of standards warrants listing a segment as not fully supporting. Likewise, limited data must be relied upon to determine whether actions taken to address water quality degradation have had the desired results. The samples taken are affected by variability in human activity and natural or background conditions. Also, there are certain acceptable tolerances for violations. For example, an occasional violation of a dissolved oxygen standard, even if by anthropogenic sources, may not be critical for the aquatic environment. In addition, measurement errors in the analysis of the samples collected could be yet another reason why the numeric standard might be violated in a sample. It appears that the EPA guidelines recognize these arguments because the guidelines require a water to be listed only if more than 10% of the samples violate the standard. In effect, the assessment guidelines imply that a violation of the numeric criterion is acceptable in 10% of the samples taken.

If the number of samples at a stream location greatly increases in frequency, conceptually approaching one for each hour (for example), the EPA guidelines suggest that it is acceptable for a standard to be violated 10% of the time. The remainder of this section describes the two assessment methodologies used in this report: the EPA Percent Method and the Binomial Assessment Method.

The EPA Percent Method:

EPA has proposed an assessment method for the 305(b) report based on assumptions about the kind and frequency of data needed to support such an assessment. The object is to indicate whether waters are fully, partially, or non-supporting for the designated uses. EPA has proposed two thresholds for this purpose, an 11% and a 25% violation rate for conventional pollutants. These percentages are fixed. Table 3.2-2 summarizes the EPA fixed rate assessment parameters.

Table 3.2-2 **EPA fixed rate assessment parameters**

Violation Rate of Total Samples Analyzed	Assessment
R # 10%	Meets use
11% < rate < 25%	Partially meets use
R \$ 25%	Fails to meet use

R = violation rate

Designated Use Assessment Criteria

Virginia bases its water quality assessment on the ability of the waters to support the five designated uses. Support is based on the waters meeting the criteria for each use based on the numeric and/or narrative Water Quality Standards. The following is a description of the criteria used to determine the quality of the waters relating to each of the designated uses.

Fully Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting the designated uses.

Conventional Pollutants:

Waters fully supporting the designated uses can have one violation and up to 10% total violations of water quality standards for conventional pollutants such as fecal coliform bacteria, dissolved oxygen, temperature, and pH. This criteria is based on EPA guidance which recommends that the States use a violation rate of

Water Quality Standards in the 0-10% range as fully supporting the aquatic life and swimming designated uses.

Toxic Pollutants with Water Quality Standards:

For toxic pollutant assessment in free-flowing streams, waters where no more than one exceedance of a Water Quality Standard within a 3-year period are considered fully supporting for aquatic life. Additional information on the analysis of toxic data is described in Part VI Section 6 and Section 7 of the 305(b)/303(d) *Guidance Manual*.

For toxic pollutant assessment in estuarine waters, a weight of evidence approach has been initiated for this assessment cycle. Additional information on the details of using this approach can be found in Part VI, Section 11 of the 305(b)/303(d) *Guidance Manual*.

Biological Data:

For free-flowing stream benthic community assessment, data for the overall assessment period is rated as not impaired or slightly impaired where no biological assemblage (e.g. fish, macro invertebrates or algae) has been modified significantly beyond the natural range of reference conditions.

For estuarine benthic community assessment, sampling results are characterized using the benthic index of biotic integrity (B-IBI) developed and used by the Chesapeake Bay Program. This approach is based on a comparison of benthic sampling data to reference sites that were deemed minimally impacted by low dissolved oxygen events and sediment contaminants. Additional information on the estuarine benthic assessment program can be found in Part VI, Section 11 of the 305(b)/303(d) *Guidance Manual*.

Fish Advisories:

Waters where the Department of Health has not issued any fish advisories or prohibitions and no human health standards or national screening values have been exceeded.

Shellfish Advisories:

Those growing areas where no restriction or prohibition on shellfish harvesting is imposed as indicated by the Department of Shellfish Sanitation (DSS) summary dated January 1999. Also, only 1 exceedance maximum and < 11% exceedances of Water Quality Standards for shellfish areas have been detected.

Beach Closures:

No VDH beach closures during the assessment period.

Drinking Water Source Closures:

No VDH drinking water restrictions limiting consumption due to anthropogenic activities or closures during the assessment period.

Fully Supporting but Threatened

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting but threatened for the designated uses.

Threatened Waters:

Waters where Aevaluated@ data, trend analysis, or other water quality indicators show an apparent decline in water quality or a potential for water quality problems. Waters can be designated threatened where there is a possible loss of a designated use documented by ancillary data such as recurrent fish kills or pollution potential documented by non-agency studies or reports. Threatened waters, generally, may have some violations of water quality standards for conventional parameters or potential for moderately impaired biological conditions and should include follow-up monitoring.

Fish Tissue/Sediment Contamination:

For waters where trend analysis on monitored data show a decline in water quality but overall, are not above the 10% violation rate could be considered fully supporting but threatened. Additionally, evaluated data that shows a potential water quality problem may be considered fully supporting but threatened.

For fish tissue or sediment contamination, waters exceeding a screening value (SV) or ER-M value, respectively, are fully supporting but threatened. If an ER-M value does not exist, then the 99th percentile value is used.

Biological Data:

For free-flowing waters, biological community data for the assessment period with a single rating of moderately impaired using RBP II methodology could be considered fully supporting but threatened where professional judgement cannot confirm a loss of aquatic life use. Additionally, where evaluated biological data or best professional judgment reveals potential water quality problems; these waters could be considered fully supporting but threatened. For waters assessed as fully supporting but threatened for aquatic life use, it is necessary for follow-up biological assessment to be scheduled to make a final aquatic life use determination. Additional information can be found in Part VI Section 8.2 of the 305(b)/303(d) *Guidance Manual*.

For estuarine waters, the B-IBI status is rated as Amarginal® and the supporting data has been reviewed and confirmed by DEQ Chesapeake Bay Office (CBO) and the appropriate regional office.

Shellfish Advisories:

Those growing areas that DSS has classified as conditionally approved are considered fully supporting but threatened. This would include those condemnations listed as seasonal condemnations in the annual DSS summary. Additional information on shellfish assessment and consumption use is contained in Part VI, Section 6.3 and 6.4 of the 305(b)/303(d) *Guidance Manual*.

Discussion: Additional consideration should be given where the restriction on direct marketing and requirement for relaying is in effect during a period of the year when virtually no harvesting occurs. Likewise, consideration should be given during the period of the year when harvesting is active but the activity requiring the conditional approval is absent and no restrictions on marketability are imposed causing no significant impact to the resource. The area is only considered threatened where the presence of the activity that causes the temporary harvesting restriction is actually taking place.

Beach Closure:

One, short term (less than one week in duration) VDH beach closure within the 5 year assessment cycle with a low probability, based on best professional judgement, that the pollution will reoccur is considered fully supporting but threatened. Best professional judgement decisions could be based on the source of the pollution causing the closure being generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One, short term VDH drinking water source closure during the 5 year assessment cycle with a low probability that the pollution will reoccur are considered fully supporting but threatened. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Not Fully Supporting Waters

The following is a description of the types of data and the acceptable criteria used to assess waters as not fully supporting for the designated uses.

Conventional Parameters:

Not fully supporting waters are those with long term or chronic water quality problems. Not fully supporting waters can be designated partially supporting or not supporting for any or all of the five designated uses.

For conventional pollutants, the number of samples exceeding the standard is used to determine if the water is partially or not supporting. EPA guidance recommends that the States use a violation rate of two or more violations and a violation rate between 11% - 25% of the total samples for partial support and greater than 25% of the total samples for not supporting.

Toxic Parameters:

Not fully supporting waters are those for which more than one violation has occurred in a 3-year period but less than 10% of the total samples. The toxic standards protect aquatic life and human health uses (primarily water supply). Depending on the pollutant, the water should be assessed against both designated use standards independently. Waters failing to meet one of these uses should be designated as partially supporting for that use. Waters should be designated not supporting for both uses when both uses are not met.

Discussion: EPA's 1998 assessment guidance determines partial support from not supporting by the arithmetic percentage (total violations/total samples x 100 = arithmetic percent) of samples exceeding the standard. Violations exceeding 10% are not supporting and violations of 10% or less are partially supporting. We have real concerns with this method because the toxic standards are parameter and designated use specific. For example, the carcinogen trichlorophenol, has a standard for human health use (drinking water) but none for aquatic life. A violation in excess of 10% for this parameter can only be for the one designated use and therefore partially supporting for that use. Other toxic pollutants such as aldrin, have standards for aquatic life and human health. Violations of the standard for both uses would be classified not supporting for each designated use.

All localities, PDCs, Health Department Districts, and Soil and Water Conservation Districts are notified and provided information on the not fully supporting waters within their jurisdictional boundaries.

Partially Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as partially supporting the designated uses.

Conventional Parameters:

Waters with long term or chronic problems based on the assessment of monitored data. For conventional parameters, violations of water quality standards in the 11-25% range are considered a long term or chronic problem and considered partially supporting. Waters with violations in this range are capable of supporting some of the designated use according to EPA guidance.

Toxic Pollutants:

For toxic parameters, waters violating the water quality standard more than once within a 3-year period but less than 10% of the total samples analyzed.

Biological Data:

For free-flowing waters, a biological community survey data rated as moderately impaired is generally considered partially supporting. Based on professional judgement and/or other supplemental data, a second survey may be required to confirm moderate impairment. In this case, the initial assessment would be considered fully supporting but threatened.

For estuarine waters, the B-IBI status is rated as Adegraded® and the supporting data has been reviewed and confirmed by CBO and the appropriate regional office.

Fish Advisories:

Virginia Department of Health fish consumption advisories, limiting consumption, are considered violations of the general water quality standard and therefore considered partially supporting.

Discussion: For waters where EPA and/or the Commonwealth have completed remedial action or decided not to implement control measures, a brief summary of the federal/state action and a statement that a TMDL will not be developed will be included in the 303(d) report.

Shellfish Advisories:

Those shellfish growing areas that DSS has classified as restricted will be included. This includes all shellfish condemnations that are not seasonal or other prohibitions as listed in the annual DSS summary.

Discussion: The loss of resource in the restricted areas is a partial loss since the DSS allows harvesting and marketing after relay for cleansing of contamination. The waters therefore partially support the beneficial shellfish use.

Beach Closures:

One or more VDH beach closures of less than one-week duration within the assessment cycle with a medium probability, based on best professional judgement, the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures within the assessment cycle with a high probability that the pollution will reoccur. There are plans to implement pollution reduction measures or controls.

Not Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as not supporting the designated uses.

Conventional Parameters:

Waters with severe long term or chronic problems based on the assessment of monitored data. Waters with conventional parameter violations of more than one violation and greater than 25% do not support any of the associated designated uses according to EPA guidance.

Toxic Pollutants:

Waters where there is more than one exceedance of a toxic parameter and greater than 10% of the total samples analyzed.

Biological Data:

For free-flowing waters, biological community data for the assessment period is rated as severely impaired using the RBP II survey.

For estuarine waters, the B-IBI status is considered severely degraded and the supporting data has been reviewed and confirmed by CBO and appropriate regional office.

Fish Consumption Advisories:

Virginia Department of Health fish consumption prohibitions, banning all fish consumption, are considered violations of the general Water Quality Standard and considered as not supporting.

Shellfish Advisories:

Those growing areas that DSS has classified as prohibited, with the exception of those areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted out-fall. This includes those shellfish condemnations that are listed; Ait shall be unlawful for any person, firm, or corporation to take shellfish from these areas, for any purpose.®

Discussion: The loss of resource in the prohibited areas is a total loss since the DSS does not allow relaying to remove contamination, harvesting, or marketing of the shellfish resource that may be present.

Beach Closures:

One or more VDH beach closures, of more than one weeks duration during the assessment period, with a high probability, based on best professional judgement, that the pollution will reoccur and additional closures will result. VDH initiates plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures with a high probability that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls. Table 3.2-3 summarizes the designated use support criteria used in the water quality assessment according to the EPA Percent Method.

Table 3.2-3 **EPA Percent Method Designated Use Assessment Criteria**

	FULLY SUPPORTING	FULLY SUPPORTING	NOT FULLY SUPPORTING	NOT FULLY SUPPORTING
	Fully Supporting	Fully Supporting but Threatened	Partially Supporting	Not Supporting
Conventional Pollutants	R ≤ 10%	NA	R > 1 exceedance and 11% ≤ R ≤ 25%	R > 25%
Toxic Pollutants	No more than 1 exceedance in a 3 year period (10 sample minimum)	* See fish tissue and sediment criteria	R > 1 Exceedance and ≤ 10% of samples (10 sample minimum)	R > 10 % samples (10 sample minimum)
Biological Data	Not Impaired or Slightly Impaired	Unconfirmed, Moderately Impaired, Evaluated data show potential WQ problems	Confirmed Moderately Impaired or degraded (or two surveys shows moderate impairment)	Severely Impaired or Degraded
Fish Consumption Advisories or Restrictions	None	NA	A VDH advisory <i>limiting consumption</i> is in place	A VDH restriction <i>prohibiting consumption</i> is in place
Shellfish Restrictions or Prohibitions	None	Area classified as Conditionally Approved (includes seasonal condemnations)	Areas classified as Restricted	Areas classified as Prohibited (exception: VPDES mixing zone areas)
Beach Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any control measures)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)

Drinking Water Source Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any control measures)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)
* Fish Consumption Criteria		* Sediment Criteria		
If one or more Level 1 samples exceed one or more risk based SV's – threatened for fish consumption <ul style="list-style-type: none"> • Cause: violation of SV for affected parameter • Source: unknown 		If one or more ER-M SV(s) or if no ER-M exists, 99 th percentile SV exceed – threatened for aquatic life. <ul style="list-style-type: none"> • Cause: violation of SV for affected parameter 		

R = arithmetic percent violation rate

SV = screening value

ER-M = effects range – medium value

*As there are no water quality standards for fish tissue and sediment concentrations, no water body should be designated not fully supporting (partially or not supporting) based on fish tissue SV exceedance or sediment ER-M or 99th percentile SV exceedance data alone.

The Binomial Assessment Method

The method considers violations as successes in a statistical binomial population and uses the likelihood of the violations in light of two possible population violation rates, 11% and 25%. A pair of hypotheses are established for each violation rate and the chance computed of the sample coming from a population with the specified violation rate. If the sample is statistically likely to have a violation rate of 10% or less, the waters from which the sample is taken are considered suitable for the use. If the sample is statistically likely to have come from a population with a violation rate between 11% and 25%, the waters are classified partially suitable for the use. Finally, if the sample is likely to have come from a population with a violation rate in excess of 25%, the waters are considered to not meet the use. The violation rates are published in the 305(b) Report in Appendix B along with the assessment result. The statistical conclusion of supporting, partially supporting, or not meeting the aquatic life/swimmable use is recorded in the Virginia Assessment Database which is sent to EPA.

The Hypotheses:

Given environmental variability, the logic for the null is that we have no prior reason to assume that most streams are less than fully supporting and given that the conventional pollutants in most Virginia streams meet the standards, it is reasonable to hypothesize that waters are clean unless proven polluted. The hypotheses that DEQ uses to make assessments of conventional pollutant data follow this pattern. For a conventional water quality variable DEQ hypothesizes that one of the following is true.

H₀: The water quality variable exceeds the state standard = 0.10 of the time.

H_a: The water quality variable exceeds the state standard > 0.10 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H₀, we agree that the waters meet the 10% threshold. It is important to point out that the percent method has a sensitivity of error type to sample size, but sample size matters only to type I error in that approach. This aspect is essential to the debate as to the tradeoff of type I and type II error and the most scientific way to recognize and control for these errors. It is important to note that the percent method has an implied alpha of 55%. Few would recognize this as appropriate for statistical analysis.

Evaluating the Hypotheses:

The binomial distribution is used to determine which hypothesis is likely to reject the null hypothesis. This is important because we are always sampling from a population and errors are always possible regardless of the assessment method used. The population is assumed to have a violation rate of 0.10 based on a sample size of n with x violations. For a monitoring station record, the probability of obtaining x violations or more based on the sample size is calculated. To minimize incorrect assessment of the State waters, the chance of making a Type I error (α , α) is set at 20% as a way to balance type I and type II errors. Then, if the probability of the number of violations is greater than 20%, we accept H_0 and say that the represented waters meet the regulatory use implied by the variable. If not, we say the waters do not meet the use; we accept H_a .

If a violation record does not meet a use based on the first pair of hypotheses, it is further evaluated to differentiate whether the impairment is partial or full. For this purpose a second set of hypotheses are constructed.

H_0 : The water quality variable exceeds the state standard = 0.25 of the time.

H_a : The water quality variable exceeds the state standard > 0.25 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H_0 , we agree that the waters meet the 25% threshold. Because the waters did not meet the first H_0 of = 10% but met the second H_0 of = 25%, they are classified as partially meeting the designated use. On the other hand, if the violation rate leads us to reject the H_0 of = 25% and accept H_a of >25%, then the waters are classified as not supporting. This concludes the evaluation of the sample data. Table 3.2-4 summarizes the complete evaluation process.

Table 3.2-4. **Assessment of exceedances for a monitoring station.**

First set of Hypotheses Assuming $p=.10$	Second set of Hypotheses Assuming $p=.25$	Conclusion
H_0 true	H_0 true	Waters meet use
H_0 false	H_0 false	Waters partially meet use
H_0 false	H_0 false	Waters are non-supporting

In regulatory assessment of water quality data, there are four outcomes of the process. Two outcomes are correct and two are in error as shown in Table 3.2-5. We make the correct decision when we classify clean waters as clean or not fully supporting waters as partial or not supporting. We could err by stating that clean waters are not fully supporting or, we could err by stating non-supporting waters are clean. The errors need to be minimized because they represent expenditure of time and/or money on waters without problems and missing waters that may need cleaning. Although two sets of hypotheses are employed in evaluating DEQ's water quality data, the first pair is germane to this concern because it sets the stage for classifying waters fully supporting or not fully supporting. This discussion therefore applies to the first set of hypotheses shown in Table 3.2-5.

Table 3.2-5. **Decisions and errors made in hypothesis testing.**

	H_0 true, waters are clean	H_0 false, waters are not fully supporting
Accept H_0	Call clean waters clean; correct decision	call not fully supporting waters clean; Type II error (β);
Reject	Call clean waters not fully supporting;	call dirty waters not fully supporting;

H_0	Type I error (α);	correct decision
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In testing the hypothesis pair for a violation record, if the waters are truly not fully supporting for the regulatory uses and we classify them as such, the result will often be the installation of expensive treatments or repairs to clean up the dischargers or to fix non point pollution in the watershed. This is an important function for DEQ. If, however, the waters are not less than fully supporting but we classify them as such, the result will also be the initiation of an unnecessary TMDL with a good probability of the installation of expensive but unnecessary treatments or repairs. The second kind of error would be calling less than fully supporting waters clean.

The two risks are reciprocally related so that reducing one automatically elevates the other. The only way to coincidentally reduce both risks is by collecting more data. But sample collection and analysis are expensive and DEQ's budget for monitoring is finite. So there are three needs that have to be balanced in Virginia in terms of water quality assessment, minimize type I error, minimize type II error, and increase sample size. The binomial method allows for the "balancing" of type I and type II errors while the percent method does not allow for any adjustment of the type I and type II error rates even with increasing sample sizes. For the 2000 305(b) assessment, the data for testing the hypotheses about use impairment have already been collected; the collection period ended December 31, 1998. So the sample sizes are fixed and no change in monitoring would lead to a reduction in the two risks. But, changes could be implemented in the next few months to ensure more data are collected at each water quality station for the 2002 305(b) Report. That would reduce both kinds of risk.

The DEQ binomial method sets fully supporting (α) at 20%. In other words, the chance of calling clean waters less than fully supporting is 2 in 10. Type II error (β) is more difficult to establish but the DEQ binomial method has a structure that allows its estimation. This error depends on the sample size and on what one believes the impairment condition to be. In terms of use assessment for the 305(b) Report where we are testing population violation rates from a population with a rate of 0.10, a useful alternate violation rate is the upper EPA threshold of 0.25. For purposes of estimating type II error, we will assume that the not fully supporting population has a true violation rate of 0.25. Under this assumption and for a population of size 8 as an example of quarterly data over a two-year period, this error is compared to the violation rate in Table 3.2-6.

Table 3.2-6. Type II error for different violation rates (X) in a data set of 8

N	X	Probability Standard is being met; $P(= x n,.10)$	Type II Error $P(< x n,.25); (\beta)$
8	0	1.0000	.0000
8	1	.5695	.1001
8	2	.1869	.3671
8	3	.0381	.6785
8	4	.0050	.8862
8	5	.0004	.9727
8	6	.0000	.9958
8	7	.0000	.9996
8	8	.0000	1.00

The third column contains the probability of x or more violations in a sample size of n if the true violation rate is 0.10. If type II error is fixed at 20% ($\alpha = 20\%$), then for a sample of size 8, 2 or more violations would lead to a rejection of the H_0 of unimpaired water because $P(=x|8, 0.10) = .1869$ is less than $\alpha = 20\%$. The adjacent column gives the probability of type II error depending on the level at which H_0 is rejected. For a violation rate of 2 in 8, the type II error is .3671. That is, in about 1/3rd of the cases when a sample of size 8 is classified unimpaired it is actually not fully supporting.

Statistically, it is desirable to have type II error as small as possible. However, this type error changes reciprocally with type I error. If one is made smaller the other becomes larger. To demonstrate, if type I error was decreased from 0.20 to 0.10, using Table 3.2-6, it would take 3 violations as sufficient evidence that the waters are not fully supporting. Correspondingly, type II error rises from 0.3671 to 0.6785. Because type II error is larger, we are less confident about identifying waters as clean. However, at the same time with lower type II error, we are more confident when declaring waters polluted. Here, with type II error of 20%, we will incorrectly classify waters polluted 20% of the time.

Rules for Employing the Binomial Method in the 305(b):

The following are recommended guidelines for using the binomial distribution method.

Guidelines for Assessment of Water Quality Data:

1. A data set with one sample (meeting or violating standards) should be entered into ADB as monitored, but designated not assessed in the use support selection.
2. One violation in a data set consisting of 2 or more samples should be assessed as fully supporting.
3. Partial-support and non-support should be assessed using only data sets with 2 or more samples and with 2 or more violations as illustrated in Table 3.2-7.

Table 3.2-7 **Binomial Distribution Assessment Chart**

Total Number of Samples	Minimum Number of Exceedances to Declare Site Partial Supporting	Binomial Population Violation Rate (p=.10)	Actual Violation Percentage Rate	Total Number of Samples	Minimum Number of Exceedances to Declare Site Not Supporting	Binomial Population Violation Rate (p=.25)	Actual Violation Percentage Rate
2	-	-	-	2	2	0.0625	100%
3	-	-	-	3	2	0.15625	67%
4	2	0.0523	50%	4	3	0.05078125	75%
5	2	0.08146	40%	5	3	0.103515625	60%
6	2	0.114265	33%	6	3	0.169433594	50%
7	2	0.1496944	29%	7	4	0.070556641	57%
8	2	0.18689527	25%	8	4	0.113815308	50%
9	3	0.052972138	33%	9	4	0.165725708	44%
10	3	0.070190826	30%	10	5	0.078126907	50%
11	3	0.089561851	27%	11	5	0.114626408	45%
12	3	0.110869978	25%	12	5	0.157643676	42%
13	3	0.133882755	23%	13	6	0.080212593	46%
14	3	0.158359981	21%	14	6	0.11166897	43%

15	3	0.184061069	20%	15	6	0.148368077	40%
16	4	0.068406174	25%	16	6	0.189654573	38%
17	4	0.082640623	24%	17	7	0.107081582	41%
18	4	0.098196841	22%	18	7	0.138984783	39%
19	4	0.114997558	21%	19	7	0.174875884	37%
20	4	0.132953323	20%	20	8	0.101811857	40%
21	4	0.151965311	19%	21	8	0.129913406	38%
22	4	0.171927897	18%	22	8	0.161527648	36%
23	4	0.192731014	17%	23	8	0.196303315	35%
24	5	0.085074886	21%	24	9	0.121318284	38%
25	5	0.097993621	20%	25	9	0.14943767	36%
26	5	0.111835123	19%	26	9	0.1804517	35%
27	5	0.126557448	19%	27	10	0.113254636	37%
28	5	0.142111905	18%	28	10	0.138453535	36%
29	5	0.158444084	17%	29	10	0.16630495	34%
30	5	0.175494879	17%	30	10	0.196593363	33%
31	5	0.193201474	16%	31	11	0.128444433	35%
32	6	0.094398674	19%	32	11	0.153594633	34%
33	6	0.106108636	18%	33	11	0.181031216	33%
34	6	0.118529559	18%	34	12	0.119298905	35%
35	6	0.131635775	17%	35	12	0.14211302	34%
36	6	0.145397301	17%	36	12	0.167065958	33%
37	6	0.159780316	16%	37	12	0.194015131	32%
38	6	0.174747641	16%	38	13	0.131695168	34%
39	6	0.190259232	15%	39	13	0.154465924	33%
40	7	0.099516424	18%	40	13	0.179134242	33%
41	7	0.110192048	17%	41	14	0.122207354	34%
Total Number of Samples	Minimum Number of Exceedances to Declare Site Partial Supporting	Binomial Population Violation Rate (p=.10)	Actual Violation Percentage Rate	Total Number of Samples	Minimum Number of Exceedances to Declare Site Not Supporting	Binomial Population Violation Rate (p=.25)	Actual Percentage Rate
42	7	0.121447207	17%	42	14	0.143046661	33%
43	7	0.133265123	16%	43	14	0.165682461	33%
44	7	0.145626025	16%	44	14	0.190015945	32%
45	7	0.158507385	16%	45	15	0.132658446	33%
46	7	0.171884183	15%	46	15	0.153473667	33%
47	7	0.185729169	15%	47	15	0.175915078	32%
48	8	0.102065899	17%	48	15	0.199886585	31%
49	8	0.111860623	16%	49	16	0.142354969	33%
50	8	0.122145084	16%	50	16	0.163083271	32%
51	8	0.132907891	16%	51	16	0.185292167	31%
52	8	0.144135456	15%	52	17	0.132199025	33%
53	8	0.155812124	15%	53	17	0.151371549	32%
54	8	0.16792032	15%	54	17	0.171969057	31%
55	8	0.180440711	15%	55	17	0.193921665	31%
56	8	0.193352364	14%	56	18	0.140654308	32%

57	9	0.112008951	16%	57	18	0.159775923	32%
58	9	0.121471348	16%	58	18	0.18021215	31%
59	9	0.131350091	15%	59	19	0.130824603	32%
60	9	0.141635605	15%	60	19	0.148592074	32%
61	9	0.152316716	15%	61	19	0.16762865	31%
62	9	0.163380734	15%	62	19	0.187882682	31%
63	9	0.174813554	14%	63	20	0.138313604	32%
64	9	0.186599751	14%	64	20	0.156057081	31%
65	9	0.198722697	14%	65	20	0.174983456	31%
66	10	0.119923549	15%	66	20	0.195041299	30%
67	10	0.129047661	15%	67	21	0.145398137	31%
68	10	0.138533591	15%	68	21	0.163090115	31%
69	10	0.148373234	14%	69	21	0.181887842	30%
70	10	0.158557264	14%	70	22	0.135564873	31%
71	10	0.169075197	14%	71	22	0.15210879	31%
72	10	0.179915453	14%	72	22	0.169728062	31%
73	10	0.191065432	14%	73	22	0.188383762	30%
74	11	0.117810075	15%	74	23	0.141956509	31%
75	11	0.126280225	15%	75	23	0.158473897	31%
76	11	0.135076151	14%	76	23	0.176004144	30%
77	11	0.144191928	14%	77	23	0.194508293	30%
78	11	0.153620636	14%	78	24	0.148046788	31%
79	11	0.163354389	14%	79	24	0.164519504	30%
80	11	0.173384387	14%	80	24	0.181948225	30%
81	11	0.183700957	14%	81	25	0.138376422	31%
82	11	0.194293604	13%	82	25	0.153855878	30%
83	12	0.123226573	14%	83	25	0.17026944	30%
84	12	0.131419023	14%	84	25	0.187587138	30%
85	12	0.139903258	14%	85	26	0.143946538	31%
Total Number of Samples	Minimum Number of Exceedances to Declare Site Partial Supporting	Binomial Population Violation Rate (p=.10)	Actual Violation Percentage Rate	Total Number of Samples	Minimum Number of Exceedances to Declare Site Not Supporting	Binomial Population Violation Rate (p=.25)	Actual Percentage Rate
86	12	0.148674123	14%	86	26	0.159402584	30%
87	12	0.157725655	14%	87	26	0.175745452	30%
88	12	0.167051116	14%	88	26	0.192945003	30%
89	12	0.176643018	13%	89	27	0.149284605	30%
90	12	0.186493163	13%	90	27	0.164704348	30%
91	12	0.19659268	13%	91	27	0.18096736	30%
92	13	0.12766348	14%	92	27	0.198043521	29%
93	13	0.135590338	14%	93	28	0.154404441	30%
94	13	0.143781425	14%	94	28	0.169777299	30%
95	13	0.152232229	14%	95	28	0.185953216	29%
96	13	0.160937575	14%	96	29	0.144791284	30%
97	13	0.169891645	13%	97	29	0.159319025	30%
98	13	0.179088002	13%	98	29	0.174636317	30%
99	13	0.188519615	13%	99	29	0.190719473	29%
100	13	0.198178887	13%	100	30	0.149541047	30%

Fully supporting but threatened waters should be assessed using data sets with 2 or more samples with 2

or more violations that exceed a 10% simple percentage violation rate, but the violation rate is less than the number required for declaring the site partially supporting using the attached binomial table. At least 9 samples and 2 violations are needed in a data set to be designated as threatened. Table 3.2-8 summarizes these assessment guidelines.

Table 3.2-8 **2000 305(b) Assessment Summary Using Binomial Distribution Method**

# Samples	# Violations	Assessment
1	0 or 1	Not Assessed
2 or More	1	Fully Supporting
	2 or More	Partial or Not Supporting as per Binomial Distribution Table
9 or more	2 or More	Threatened if Violation Rate >10% but <Binomial Distribution Rate

Virginia bases its water quality assessment on the ability of the waters to support the five designated uses. Support is based on the waters meeting the criteria for each use based on the numeric and/or narrative Water Quality Standards. The following is a description of the criteria used to determine the quality of the waters relating to each of the designated uses.

Fully Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting the designated uses.

Conventional Pollutants:

Waters fully supporting the designated uses can have up to 10% violations of water quality standards for conventional pollutants fecal coliform bacteria, dissolved oxygen, temperature, and pH. This criteria is based on EPA guidance which recommends that the States use a violation rate of these Standards in the 0-10% range and designate as fully supporting the aquatic life and swimming designated uses.

Toxic Pollutants with Water Quality Standards:

For toxic pollutant assessment in free-flowing streams, waters where no more than one exceedance of a Water Quality Standard within a 3-year period are considered fully supporting for aquatic life. Additional information on the analysis of toxic data is described in Part VI Section 6 and Section 7.

For toxic pollutant assessment in estuarine waters, a weight of evidence approach has been initiated for this assessment cycle. Additional information on the details of using this approach can be found in Part VI, Section 11.

Biological Data:

For free-flowing stream benthic community assessment, data for the overall assessment period is rated as not impaired or slightly impaired where no biological assemblage (e.g. fish, macro invertebrates or algae) has been modified significantly beyond the natural range of reference conditions.

For estuarine benthic community assessment, sampling results are characterized using the benthic index of biotic integrity (B-IBI) developed and used by the Chesapeake Bay Program. This approach is based on a comparison of benthic sampling data to reference sites that were deemed minimally impacted by low dissolved oxygen events and sediment contaminants. Additional information on the estuarine benthic assessment program can be found in Part VI, Section 11 of this guidance.

Fish Advisories:

Waters where the Department of Health has not issued any fish advisories or prohibitions and no human health standards or national screening values have been exceeded.

Shellfish Advisories:

Those growing areas where no restriction or prohibition on shellfish harvesting is imposed as indicated by

the Department of Shellfish Sanitation (DSS) summary dated January, 1999 and no Water Quality Standards exceedances have been detected.

Beach Closures:

No VDH beach closures during the assessment period.

Drinking Water Source Closures:

No VDH drinking water source closures during the assessment period.

Fully Supporting but Threatened

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting but threatened for the designated uses.

Threatened Waters:

Waters for which “evaluated” data, trend analysis, or other water quality indicators show an apparent decline in water quality or a potential for water quality problems. Waters can be designated threatened where there is a possible loss of a designated use documented by ancillary data such as recurrent fish kills or pollution potential documented by non-agency studies or reports. Threatened waters, generally, have > 10% exceedences but less than the binomial cutoff for partial support or potential for moderately impaired biological conditions. The DCR “high priority” and WQS “nutrient enriched waters” are considered administrative threatened for “overall use”. Since many considerations relating to some or all of the designated uses are involved in these evaluated waters, they are considered threatened for overall use instead of an individual use. All threatened waters should be considered for additional monitoring during the next reporting period.

Fish Tissue/Sediment Contamination:

For waters where trend analysis on monitored data show a decline in water quality but overall, are not above the binomial cutoff for partial support should be considered fully supporting but threatened. Additionally, evaluated data that shows a potential water quality problem may be considered fully supporting but threatened.

For fish tissue or sediment contamination, waters exceeding a screening value (SV) or Effects Range-Medium (ER-M) value, at least twice, are fully supporting but threatened for fish consumption and aquatic life, respectively. If an ER-M value does not exist, then the 99th percentile value is used.

Biological Data:

For free-flowing waters, biological community data for the assessment period with a single rating of moderately impaired using RBP II methodology could be considered fully supporting but threatened where professional judgement cannot confirm impairment. Additionally, where evaluated biological data or best professional judgment reveals potential water quality problems; these waters could be considered fully supporting but threatened. For waters assessed as fully supporting but threatened for aquatic life use, it is necessary for another biological assessment to be scheduled to make a final aquatic life use determination. Additional information can be found in Part VI Section 8.2.

For estuarine waters, the B-IBI status is rated as “marginal” and the supporting data has been reviewed and confirmed by DEQ Chesapeake Bay Office (CBO) and the appropriate regional office.

Shellfish Advisories:

Those growing areas that DSS has classified as conditionally approved are considered fully supporting but threatened. This would include those condemnations listed as seasonal condemnations in the annual DSS summary. Additional information on shellfish assessment and consumption use is contained in Part VI, Section 6.3 and 6.4.

Discussion: Additional consideration should be given where the restriction on direct marketing and requirement for relaying is in effect during a period of the year when virtually no harvesting occurs. Likewise,

consideration should be given during the period of the year when harvesting is active but the activity requiring the conditional approval is absent and no restrictions on marketability are imposed causing no significant impact to the resource. The area is only considered threatened where the presence of the activity that causes the temporary harvesting restriction is actually taking place.

Beach Closure:

One, short term (less than one week in duration) VDH beach closure within the 5 year assessment cycle with a low probability, based on best professional judgement, that the pollution will reoccur is considered fully supporting but threatened. Best professional judgement decisions could be based on the source of the pollution causing the closure being generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One, short term VDH drinking water source closure during the 5 year assessment cycle with a low probability that the pollution will reoccur are considered fully supporting but threatened. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Not Fully Supporting Waters

The following is a description of the types of data and the acceptable criteria used to assess waters as not fully supporting for the designated uses.

Conventional Parameters:

Not fully supporting waters are those with long term or chronic water quality problems. Not fully supporting waters are designated partially supporting or not supporting for any or all of the five designated uses. For conventional pollutants, the number of samples exceeding the standard is used to determine if the water is partially or not supporting. EPA guidance recommends that the States use a violation rate of 11% - 25% for partial support and greater than 25% for not supporting. Virginia compares these violation rates to the binomial assessment method to determine partial and non-support.

Toxic Parameters:

Not fully supporting waters are those for which more than one violation has occurred in a 3-year period but less than 10% of the total samples. The toxic standards protect aquatic life and human health uses (primarily water supply). Depending on the pollutant, the water should be assessed against both designated use standards independently. Waters failing to meet one of these uses should be designated as partially supporting for that use. Waters should be designated not supporting for both uses when both uses are not met.

Discussion: EPA's 1998 assessment guidance determines partial support from not supporting by the arithmetic percentage (total violations/total samples x 100 = arithmetic percent) of samples exceeding the standard. Violations exceeding 10% are not supporting and violations of 10% or less are partially supporting. We have real concerns with this method because the toxic standards are parameter and designated use specific. For example, the carcinogen trichlorophenol, has a standard for human health use (drinking water) but none for aquatic life. A violation in excess of 10% for this parameter can only be for the one designated use and therefore partially supporting for that use. Other toxic pollutants such as aldrin, have standards for aquatic life and human health. Violations of the standard for both uses would be classified not supporting for each designated use.

All localities, PDCs, Health Department Districts, and Soil and Water Conservation Districts are notified and provided information on the not fully supporting waters within their jurisdictional boundaries.

Partially Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as partially supporting the designated uses.

Conventional Parameters:

Waters with long term or chronic problems based on the assessment of monitored data. For conventional parameters, violations of water quality standards in the 11-25% range using the binomial method are considered a long term or chronic problem and considered partially supporting. Waters with violations in this range are capable of supporting some of the designated use according to EPA guidance.

Toxic Pollutants:

For toxic parameters, waters violating the water quality standard more than once within a 3-year period but less than 10% of the total samples analyzed.

Biological Data:

For free-flowing waters, a biological community survey data rated as moderately not fully supporting is generally considered partially supporting. Based on professional judgement and/or other supplemental data, a second survey may be required to confirm moderate impairment. In this case, the initial assessment would be considered fully supporting but threatened.

For estuarine waters, the B-IBI status is rated as “degraded” and the supporting data has been reviewed and confirmed by CBO and appropriate regional office.

Fish Advisories:

Virginia Department of health fish consumption advisories where fish consumption is limited for “at risk” individuals such as young children or pregnant women are considered violations of the general water quality standard and therefore considered partially supporting. Also, where fish consumption is limited and/or restricted but not completely prohibited.

Discussion: For waters where EPA and/or the Commonwealth have completed remedial action or decided not to implement control measures, a brief summary of the federal/state action and a statement that a TMDL will not be developed will be included in the 303(d) report.

Shellfish Advisories:

Those shellfish growing areas that DSS has classified as restricted will be included. This includes all shellfish condemnations that are not seasonal or other prohibitions as listed in the annual DSS summary.

Discussion: The loss of resource in the restricted areas is a partial loss since the DSS allows harvesting and marketing after relay for cleansing of contamination. The waters therefore partially support the beneficial shellfish use.

Beach Closures:

One or more VDH beach closures of less than one-week duration within the assessment cycle with a medium probability, based on best professional judgement, the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures within the assessment cycle with a high probability that the pollution will reoccur. There are plans to implement pollution reduction measures or controls.

Not Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as not supporting the designated uses.

Conventional Parameters:

Waters with severe long term or chronic problems based on the assessment of monitored data. Waters with conventional parameter violations of greater than 25% using the binomial method do not support any of the designated uses according to EPA guidance.

Toxic Pollutants:

Waters where there is more than one exceedance of a toxic parameter and greater than 10% of the total samples analyzed.

Biological Data:

For free-flowing waters, biological community data for the assessment period is rated as severely impaired using the RBP II survey.

For estuarine waters, the B-IBI status is considered severely degraded and the supporting data has been reviewed and confirmed by CBO and appropriate regional office.

Fish Consumption Advisories:

Virginia Department of Health fish consumption prohibitions are considered violations of the general water quality standard and not supporting due to the loss of the designated use.

Shellfish Advisories:

Those growing areas that DSS has classified as prohibited, with the exception of those areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted out-fall. This includes those shellfish condemnations that are listed; "it shall be unlawful for any person, firm, or corporation to take shellfish from these areas, for any purpose."

Discussion: The loss of resource in the prohibited areas is a total loss since the DSS does not allow relaying to remove contamination, harvesting, or marketing of the shellfish resource that may be present.

Beach Closures:

One or more VDH beach closures, of more than one weeks duration during the assessment period, with a high probability, based on best professional judgement, that the pollution will reoccur and additional closures will result. VDH initiates plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures with a high probability that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Waters Not Meeting Water Quality Standards Due to Natural Conditions

These are waters that are assessed as exceeding 10% violations of standards and the source of violations is due to naturally occurring conditions such as low DO in slow flowing swamp waters. These violations are not caused by or related to human activity past or present. DEQ does not propose to implement control measures, pollution reduction projects, or to develop TMDLs for these waters. However, DEQ will pursue a proper Water Quality Standard classification for these waters. Table 3.2-9 summarizes the designated use assessment criteria.

Table 3.2-9 Binomial Designated Use Assessment Criteria

	FULLY SUPPORTING	FULLY SUPPORTING	NOT FULLY SUPPORTING	NOT FULLY SUPPORTING
	Fully Supporting	Fully Supporting but Threatened	Partially Supporting	Not Supporting
Conventional Pollutants	AR ≤10%	AR > 10% but less than the binomial cutoff for partial support	BR > 1 exceedance and 11% = BR ≤ 25% using the binomial method	BR > 25% using the binomial method
	No more than 1	* See fish tissue	AR > 1	AR > 10 %

Toxic Pollutants	exceedance in a 3 year period (10 sample minimum)	and sediment criteria	Exceedance but $\leq 10\%$ of samples (10 sample minimum)	samples (10 sample minimum)
Biological Data	Not Impaired or Slightly Impaired	Unconfirmed, Moderately Impaired, Evaluated data show potential WQ problems	Confirmed Moderately Impaired or degraded (or two surveys shows moderate impairment)	Severely Impaired or Degraded
Fish Consumption Advisories or Restrictions	None	NA	A VDH advisory limiting consumption is in place	A VDH restriction prohibiting consumption is in place
Shellfish Restrictions or Prohibitions	None	Area classified as Conditionally Approved (includes seasonal condemnations)	Areas classified as Restricted	Areas classified as Prohibited (exception: VPDES mixing zone areas)
Beach Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any control measures)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)
Drinking Water Source Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any control measures)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)
* Fish Consumption Criteria		* Sediment Criteria		
If one or more Level 1 samples exceed one or more risk based SV's – threatened for fish consumption <ul style="list-style-type: none"> Cause: violation of SV for affected parameter Source: unknown 		If one or more ER-M SV(s) or if no ER-M exists, 99 th percentile SV exceed – threatened for aquatic life. <ul style="list-style-type: none"> Cause: violation of SV for affected parameter 		

AR = arithmetic violation rate

BR = binomial violation rate

SV = screening value

ER-M = effects range – medium value

*As there are no water quality standards for fish tissue and sediment concentrations, no water body should be designated not fully supporting (partially or not supporting) based on Level 1 Fish tissue or Sediment data alone.